

# Maple Syrup Digest



VOL. 13A, NO. 3

MAILED BY 6-1-01

OCTOBER 2001

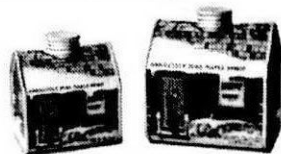
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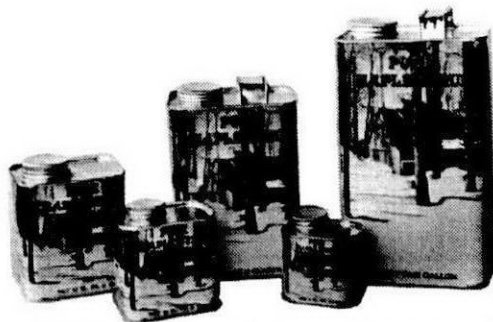
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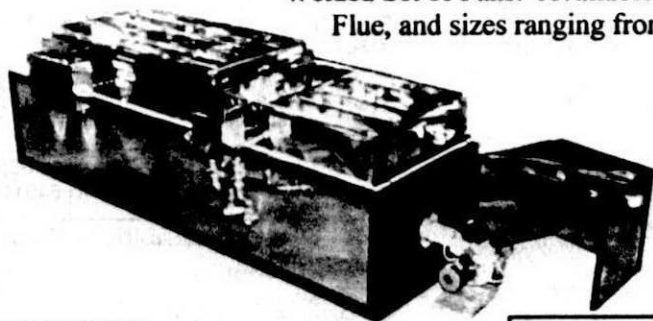


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# MAPLE SYRUP DIGEST

Official publication of the  
NORTH AMERICAN  
MAPLE SYRUP COUNCIL

## DIRECTORY

Published and Edited by:

ROY S. HUTCHINSON

P.O. BOX 240

CANTERBURY, NH 03224

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Published four times a year

(Feb., June, Oct., Dec.)

Postage paid at:

Canterbury, NH 03224

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Classified . . . . . 70c per word

DEADLINE FOR COPY: First of the  
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COVER: Lew and Lorraine Staats



# GREETINGS FROM YOUR PRESIDENT



As you read this I hope your plans are firmed up to attend the annual meeting coming up in Minnesota. It sounds like it will be a good meeting. The Minnesota people have put together an interesting program.

There are a number of topics on the agenda for the NAMSC to consider. One will be a report from the study committee on the future organization of the NAMSC. Another subject will be the Research Funding. There will also be the usual reports.

As some of you may know Lew Staats retired recently from Cornell Maple Research. As I understand, he will still be a consultant to the Maple Research.

A troubling rumor has come to light relating to Cornell Maple. It seems that Cornell will not be filling Lew's full-time position.

The above is troubling to the maple industry. Cornell is one of two premier maple research facilities in the United States. It is possible that maple may be lost at Cornell. For many years the NAMSC has funded some of the maple research done by Cornell. One project that comes to mind is the Sweet Tree program which has been a success for the maple industry. There have been other projects ranging from the sugar bush to syrup production. It would be a great loss to the maple industry if this maple research is lost.

I am sure this subject will be discussed further at the meeting in

Minnesota. If you have any comments or suggestions on this subject please let me know.

My E-mail address is Sapman@att.net or my regular mail mailing address and phone number as listed in the Digest.

Here's hoping to see many of you in October in Minnesota.

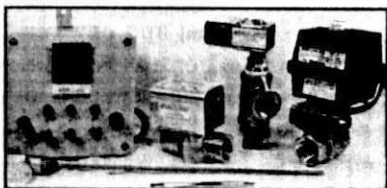
Hank Peterson  
President

## EDITOR'S NOTE

**We are in the process of getting a new computer so that we will be able to receive E-Mail.**

**Our E-Mail address will be published in the December Digest.**

Roy



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## MAPLE IN MINNESOTA 2001

There is still time to register for the 2001 North American Maple Syrup Council (NAMSC) and International Maple Syrup Institute (IMSI) meeting scheduled for October 21-24 at St. Cloud, Minnesota. Exhibits, trade show, educational/technical programs, poster sessions, field trips and a host of other events are planned for the four day meeting. You can register for the entire program or sign up for a single day. Whether you are a first time producer, or a seasoned professional you don't want to miss this meeting.

The meeting begins on Sunday, October 21st with a tour of St. John's Abbey, luncheon, beautiful arboretum, forest operations, and maple operations. In the evening enjoy a "Welcome to Minnesota" and light refreshments.

On Monday the meetings of the NAMSC and IMSI are scheduled along with technical and educational sessions in the afternoon. A variety of companion tours and events have been scheduled. The Taste of Minnesota Buffet is scheduled for Monday evening.

On Tuesday the all day field tours will take place. A variety of maple operations, and several regional and national industries will be visited. An evening discussion session entitled "What's New in Your Sugarbush" is planned while you make and enjoy your own sundae dessert treats with friends and fellow producers.

The final day of the meeting, Wednesday, is packed with technical and educational programs, exhibits,

meetings, companion tours and workshops. The annual banquet, awards, and entertainment completes the event.

We hope you plan to attend the meeting and look forward to seeing you in a few weeks. If you need registration materials of additional information contact:

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# NOTES FOR THE IMSI

By Larry Myott  
Executive Secretary

## MINNESOTA BOUND

Being a part of the International maple industry is a privilege. That's the way I look at my involvement with the IMSI and NAMSC, I first attended an international meeting, at the urging of Dr. Mariafranca Morselli, in Pennsylvania. We sat in this old movie theater for the general session and I became hooked on the international workings of the industry. Since then I have only missed two of the joint international sessions, not by my choice.

Back at my first meeting, in the 80's, I would never have dreamed that I would be someday the chair of the largest international session ever held, or that I would one day be the Executive Secretary of the IMSI. I have been encouraged to participate by sugarmakers, the Vermont maple leadership, and the international maple leadership. It is a real honor.

As we approach the Minnesota sessions, I look forward to seeing old friends and making new friends. I look forward to the sessions, some boring and most exciting. The technical sessions will be very useful to me and provide me with new ideas and fodder for future maple training sessions.

We'll have tours that will provide new ideas and perhaps some history. We'll have presenters that will give us a lot to think about and posters that will allow us to take home some science. Research projects will be presented, eliminating some theories and confirming other theories.

The best of the best sugarmakers will be in attendance to share their production ideas. All of the modern maple equipment will be on display for sales and education, too.

Demonstrations will take place to teach all participants how to do it by today's current methods. Warning will be issued about what not to be doing, and recommendations will be made on how to do it better and more efficiently.

In short, I really look forward to attending and being a part of this fraternity of maple people that are so special.

## MAPLE PROMOTIONS VERY SUCCESSFUL THIS FALL

Agricultural fairs around the country are a great place to promote our real maple syrup and real maple products. I would like to see a study as to the impact of these fair promotions on the industry. In Vermont, many fairs have maple sugarhouses that are attractions in themselves. I know that other states have also developed this concept. New York has several successful fair promotions, including the New York State Fair.

In New Hampshire, several fairs also have sugarhouse operations. Some are owned by the fair and some are privately owned. How about other states and provinces? How do you promote maple at your fairs, the *Maple Digest* would be a great place to report and give the rest of the maple world some new ideas for promotion.

Perhaps a poster display at the Minnesota session would be to explain your maple promotions. Bring your ideas to share.

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# THANKS LEW, FOR 36 SWEET YEARS!

By Warren Wells

Northeastern New York sugarmakers were hosts for a surprise retirement picnic for Lew and Lorraine Staats. The event was held at the West Chazy Recreational Center on August 11, 2001. Sugarmakers from all around New York, as well as Massachusetts and Canada convened to honor Lew for his thirty-six sweet years of dedicated work for the maple industry of North America. Lew as especially pleased that all his family could get together at one time. This hasn't been possible very often in the past.

Given Lew's love for the outdoors via hunting and fishing trips, gifts centered in those areas. Lorraine, who was in on the surprise said she never lied so much in her life, in order to keep it a secret from Lew.

The front cover photo shows Lew and Lorraine relaxing in the new Amish love seat rocker. This lovely love seat was a gift from the Western New York area maple producers. It was presented to them at the banquet of the recently held New York Tour. For thirty-six years Lew has been Mr. Maple — his talents extended to research, extension, production and publications. He travelled extensively throughout New York State conducting numerous county maple schools. Lew was the originator of the satellite maple schools which are beamed to many maple producing states as well as provinces of Canada. Lew's research and publication efforts took

him to many states. His list of publications is impressive. Lew also developed a series of maple instructional videos that are important teaching tools for the novice as well as the experienced producer.

Lew, we were selfishly hoping that you'd never retire, for we realize that someone of your caliber only comes along once in a lifetime!

Thanks again Lew, enjoy many happy retirement years!

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# NEWS FROM MAINE

By Dawn Bolduc

Spring to Fall encompasses many activities in this northeast corner. Our season got off to a start with a small contingent accompanying Bob Smith to his induction to the Maple Hall of Fame at Croghan, NY — a notable rite for Bob, and our state as well.

On June 8th over 100 maplers, representing nearly 2 million taps, met in Jackman to form the very first individual county organization here. It was an all day meeting with U.S. government, State and business speakers, as well as an international conference call with the U.S. Embassy in Ottawa. Enthusiasm peaked when by-laws were put in place as well as the following officers: President, Alfred Bolduc, Vice President, Bob Smith; Secretary, Guy Labonte and Treasurer, Danielle Rodrigue, and seven directors representing the Golden Road Co-op, the Dorchester Co-op, the Jackman area and Southern Somerset County maplers. Since that epic meeting these directors have met three times furthering their goals in recognition, marketing, and international cooperation. There is a lot of discussion about this singular county group. The MMPA feels a second maple organization may threaten the goals of the present group. In fact, all the members of the Somerset Maine Sugarmakers Association — who have made their area the number one maple producing county in U.S.A. are all members of the MMPA.

Scanning our summer fairs: a group of MMPA members manned the booth at "La Kermesse" featuring products

under the MMPA label, traditional taffy and ice cream and maple sundaes. Once again it was conspicuous that most of the help was represented by mid and north state maplers. As more venues crowd the season we really welcome and need more participation from other areas of the state. An unmanned exhibit of maple products was set up for the week long Skowhegan State Fair. New this year, Cumberland Fair is building a full-time authentic sugarhouse. MMPA will not be attending the BIG E this year due to recent changes in the corporate structure of the Maine State building, our space request was not acted upon, but favored one MMPA member who would be there the full duration of the fair. Once again, the Fryburg Fair maple booth will be manned by various members who vend their own maple products as well as MMPA labeled syrup.

## DROPS IN THE BUCKET

In our travels to a number of other states we find considerable controversy about the syrup grading system in the Maine 2001 season. Dave Gagnon, Director of Assurance and Regulation, Dept. of Agriculture, Station 28, Augusta, ME would appreciate your comments — or you could write to MMPA.

Maine will be represented at the NAMSC/IMSI meeting in St. Cloud, MN. If you would like to be part of our travel plans, please contact Bob Smith at: [smithmapleproducts.com](http://smithmapleproducts.com).

In documenting the producers, three very large maplers were inadvertently overlooked. This added census will be true because these operations all have paid leases.

A "backwood" new owner has recently discovered a potential stand of over 100,000 taps on which he is considering maple development — a huge addition to any state's tally.

Your NAMSC representative, Bob Smith and IMSI representative, Al Bolduc, have attended all the scheduled meetings that have addressed the national and international concerns on quality control throughout this industry. A notable conclusion was the crack down on users and manufacturers of the outlawed paraformaldehyde tablets.

Bulk supplies of Maine syrup are diminishing rapidly, though by the time you read this, two large sugar-

makers who have, to the point, held their production, will have released their stock to ease the holiday demand.

September 14th meeting of the MSCSA was at the Four Seasons Restaurant in Jackman. September 6th MPPA featured John Rebar, head of the University Extension Services speaking on their involvement and budget additions to cover this expansion. More about the results of these gatherings in the next Maple Digest.

We're on the move — addressing growth and marketing and stuff — come to our meetings — bring a neighboring mapler.



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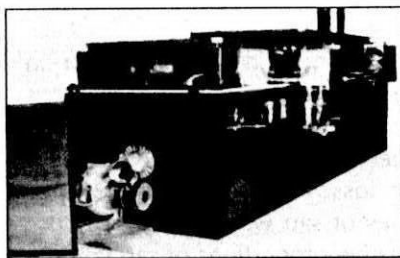
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# CORNELL UNIVERSITY CONTINUES ICE STORM RECOVERY PROGRAM TO MONITOR SUGAR MAPLE HEALTH & PRODUCTIVITY

By

*Colin A. Campbell, Chuck Winship  
and Lewis J. Staats*

In response to the 1998 ice storm and its impact on sugar maple and maple producers in northern New York, Cornell University implemented a program to research the recovery of sugarbush stands and evaluate sap yield from ice damaged sugar maples. An overview of conditions observed by field personnel during the fourth year of the research are presented for two of the projects; (1) sap volume and sugar concentration of ice damaged sugar maples and (2) sugarbush recovery monitoring. All project work is implemented by staff based at the Uihlein Field Station of Cornell University at Lake Placid, New York.

The study "Sap volume and sugar concentration of ice damaged sugar maples" was a challenge with the deep snow and poor sap runs experienced during the 2001 maple production season. This project is located near Lake Placid on an ice-damaged area of an active sugarbush. The study site was designed to evaluate sap production for trees categorized by four levels of crown loss. Although much smaller volumes of sap were found in 2001, the relative proportions of sap volume yields to the crown damage classes were consistent with that of previous years. In general, trees in the 11-25% damage class showed the highest

increase in amounts of sap volume and sugar content in the four years of study, as high as an average of 17.5 gallons of sap per tap at 2.6% Brix in 2000. This could suggest that a small amount of crown loss could be stimulating which a proper practice of pruning could encourage. However, the trees that experienced crown loss by the ice storm received ragged wounds, not the clean cuts produced by proper pruning. It is also uncertain at this time how the damage sites caused by loss of branches will heal over time. Relative sap volumes among classes remained consistent for the first two years but the more severely damaged classes increased over the last two years of the study. This suggests that after two growing seasons trees in the 51-75 percent crown loss class are showing recovery. Sap sugar concentration differences between the crown class categories have remained insignificant although slight overall differences between years have taken place which should be expected. All of the trees selected for the study in 1998 remain productive at this time.

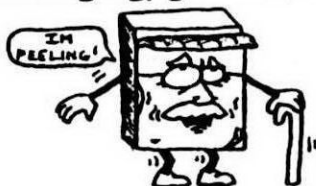
The second study "Sugarbush recovery monitoring" continues to provide information on the health and vigor of sugar maples in active sugarbushes across an array of growing sites. This study examines 284 trees of mixed species, but predominately sugar maple, in 12 sugarbush locations in northeastern New York. The 12 sugarbushes are located in the four counties most severely damaged by the ice storm; St. Lawrence, Franklin, Clinton, and Essex counties. With the data collected during the field measurements this summer along with general observations and discussions with producers

participating in the study, indications are favorable that the majority of the trees will survive. Large diameter mature trees within the study plots that were severely damaged are continuing to express an increase in diameter and maintain taphole closure. The crown branches that survived the storm along with newer epicormic branches are not showing large amounts of dieback.

The data and observations resulting from the annual monitoring provide support for sugarbushes properly managed and consisting of uneven aged stands. Uneven-aged stands, including 5-20 inch diameter sugar maples, may have had more opportunity to offer additional crown support within the stand resulting in lower percentages of crown damage and tree failure. Sugar maple stands that

were more evenly mixed in age with saplings and small diameter trees relative to the larger mature trees did not suffer high percentages of damage and are now providing enough shade to sustain medium to heavy maple regeneration. Even-aged stands of mature and overmature sugar maples suffered the worst crown damage. Mature and overmature sugar maples generally have large diameter limbs supporting larger areas of branch and twig surface which carried heavier ice loads and were less flexible than the limbs of younger trees. In the stands of even-ages mature to overmature sugar maples that were heavily damaged the increased sunlight has changed the micro-climate of the forest floor considerably and has encouraged the growth of many light tolerant

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plant species at the expense of sugar maple regeneration. Sugarbushes with even-aged mature stands and large amounts of ferns, possibly as a result of past cattle grazing practices, are now expressing an increase of ground cover such as raspberries, blackberries, and black cherry due to the increase in sunlight in the understory. Not as efficient at compartmentalization as other species like sugar maple, an increase in white birch and yellow birch mortality was found during this fourth year of monitoring.

At the time data was collected, in early August, all of the sugarbushes were experiencing severe drought conditions with a reported yearly rainfall of 6-7 inches below normal. Many shallow rooted ground cover and shrub species including the raspberries and blackberries were heavily wilted from the dry weather and not as dense as in previous years. The sugar maple saplings and trees appeared sat-

isfactory except leaf curling, and lack of deep green color foliage was observed occasionally. Leaf margins did not show any signs of browning or burning during this period of deficit rainfall for most of the region.

The insect pest most often observed was the maple leaf cutter, present in medium to high numbers in all 12 sugarbush locations. The maple leaf cutter was not observed in large numbers during the previous three years' field monitoring. Damage as a result of the sugar maple borer during pre-storm years, however, has been noted in a number of the sugarbush locations.

Although one cooperating producer stated that many heavily ice-damaged over-mature sugar maples within other areas of his sugarbush were dying or dead, observations in our study plots indicate that the majority of sugar maple trees are continuing to survive. Producers are very interested in the health and recovery of their



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trees and have responded by tapping conservatively. Many producers have also converted to the use of small diameter spouts which offer promise for lower impact to the tree tapping zone. The ice storm sugarbush monitoring project is planned to continue through the 2002 growing season. A report of the 5 years of the project will be completed at that time.

We would like to thank all of the maple producers who have served as cooperators for this study. Their interest and support is greatly appreciated. Funding from Cornell University-

College of Agriculture and Life Sciences, Cornell Cooperative Extension, the USDA Forest Service Northeastern Area State and Private Forestry, the New York State Department of Environmental Conservation Division of Lands of Forest, and the North American Maple Syrup Council is greatly appreciated. For more information regarding the Cornell sugar maple ice storm recovery project, you may contact Colin Campbell at the Uihlein Field Station at (phone) 518-523-9337 or email: cac49@cornell.edu.



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# NEW YORK NEWS

By Marion Wells

Upper Hudson Maple Producers celebrated summer with a picnic at the new sugarhouse of Mike & Nancy Hill and Ralph & Janet Senecal. The new facility and sugarbush is situated in the Athol - Thurman area of Warren County. Mike and Ralph previously tapped all the maples in downtown Warrensburg. Their new layout allows them to use a vacuum system and R.O. along with a new 3' x 12' evaporator, and 2' x 6' finishing unit. There wasn't any shortage of snow last spring with snow piled up eight feet to the eaves of their sugarhouse. Some areas of the bush never were tapped due to the extremely deep snow.

The Washington County Fair seem to have recovered from all the adverse publicity of a year ago. Good crowds flocked to the Upper Hudson Sugarhouse and helped set a new record for sales.

This years Charles Hubbell Award for outstanding contribution to the New York Maple Industry was presented to Earl Parker of West Chazy. The award was presented by Ray Christiansen, special assistant to the Commissioner of Ag & Markets, at the evening banquet of the New York Tour. Earl, his wife Pat, and family run a dairy and maple farm that has been in the family for generations. Earl has been very active in maple circles - he was president of Northeastern N.Y. Maple Producers Association, as well as president of the State Maple Association. Earl was also a long time delegate to IMSI. Earl and family were very active when the ice storm devas-

tated sugarbushes in Northern, N.Y., helping producers work with government agencies to receive financial assistance.

## MAPLE PRODUCERS ELECT NEW OFFICERS

This Spring and Summer has brought changes in officers for many Maple Producer Organizations.

Beginning at NYSMPA - at its June meeting, elections resulted in naming Thomas Todd of Norwood, NY, President; Gerald Gushman of Plymouth, Vice President and Lyle Merle of Attica, Secretary/Treasurer.

At the Central Association meeting in May - Reed Baker of Bainbridge was elected President and Gary Coles of Whitney Point re-elected Vice President.

The Chenango Area Maple Producers elected Gary Coles, President and Reed Baker, Vice President.

The American Maple Museum in Croghan have announced that the following persons were elected: President - Vern Lyndaker, Vice President - Donny Moser, Secretary - Eleanor Allen, Treasurer - Kemit Lyndaker; Directors: Gary Chartrand, Esther Lehman, Kermit Lyndaker, Donny Mosher, Tom Schneider, Nelson Widrick, Jane Yancey, Jerry and Linnea Cushman and Dick Cean.

Best wishes to all these folks and thanks for the leadership you will provide.

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# COMPARING SOME KEY ATTRIBUTES OF SUGAR MAPLE (*Acer Saccharum* Marsh) and BLACK MAPLE (*Acer Nigrum* Michx)

By *Dave Chapeskie*  
*Agroforestry Specialist, OMAFRA*

Sugar maple and black maple are often found growing in association in southern, south central and eastern Ontario. Black maple occurs over a much more restricted natural geographic range and is usually far less abundant than sugar maple. Black maple is absent or extremely scarce in central and northern Ontario. Many

landowners and even some foresters do not recognize the rather subtle distinctions between these two species. Many maple producers are uncertain whether or not black maple is growing in association with sugar maple in their sugar bushes. This is not surprising, since the two species are closely related and intermediate forms are common.

The purpose of this article is to shed some light on important and often observed differences between the two species and to discuss the comparative sweetness of their sap.

## TREE IDENTIFICATION

**The Leaves:** The leaves of sugar maple normally have 5 very distinct taper pointed lobes and have a smooth under-surface without hairs



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along the veins. The leaves turn yellow to brilliant orange and bright red in autumn.

The leaves of black maple usually have 3 distinct lobes with dense, brownish velvety hairs on the under-surface. The leaves of black maple turn yellow to brownish yellow in autumn, seldom red like sugar maple.

**The Bark:** The mature bark of sugar maple has vertical ridges curled along one side and is gray or dark gray in colour.

The mature bark of black maple has firm irregular ridges and can be quite scaly. It tends to be somewhat darker in colour than the bark of sugar maple, dark gray bordering on black.

**Site Association:** Field observations indicate that black maple tends to be associated with somewhat moister sites within a woodland area compared to sugar maple. It is a good idea to consider this when you are attempting to determine if both species reside in your woodlot.

**Natural Hybridization:** Since sugar maple and black maple are closely related species, they hybridize freely in nature. The hybrid form tends to exhibit characteristics of both species.

### SAP SWEETNESS

Both sugar maple and black maple are prized for the excellent sap quality which they yield.

Many maple producers believe that the sap of black maple is sweeter than the sap of sugar maple but is this really the case? There does not appear to be any scientific evidence to substantiate this claim.

Sap obtained from sugar bushes in eastern Ontario usually has a sap sweetness in the range of 2 to 3%.

Very occasionally an average sap sweetness up to 4% is achieved, but it is thought that this higher level relates primarily to the history of stand management.

Over the past several years, sweet tree testing of both sugar maple and black maple has been carried out in eastern Ontario. Vigorous trees with well-developed crowns of both species often exhibited readings in the range of from 3 to 6 percent. More intensive testing in the future would be needed to fully validate these findings.

### SAP VOLUME YIELD

It is unknown whether or not there is a difference in sap volume production for the two species.

### POPULAR TREE IDENTIFICATION REFERENCE

Similarities and differences between sugar maple and black maple are well described in the popular book entitled "Trees of Canada" by John Laird Farrar. The book sells for about \$45.00 and makes an excellent addition to the family reference library.

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# NEWS FROM THE AMERICAN MAPLE MUSEUM

By Eleanor Allen

It's hard to believe that another summer has turned into Autumn and the prevailing color outside my window has changed from the greenish-brown of draught-stricken grass to the red and gold of turning leaves. The Maple Museum is also getting a fresh look with a new coat of paint in the hallways and some of the rooms, thanks to the work of our Museum Curator and two summer interns.

At the re-opening ceremonies in May, Avard Bentley, of Westchester, Nova Scotia, Robert Smith, of Skowhegan, Maine; and Marion Paul, of Lanark, Ontario, were inducted into the Maple Hall of Fame. The lawn was filled with demonstrations and displays by manufacturers of maple equipment and several craft-booths manned by local craftspeople. A young fiddler, David Kaup entertained with lively fiddle music. NYS Maple Queen, Laurie Jean Fanfarillo, of Herkimer County handed over her crown to Ruth Dowe of St. Lawrence County, in the NY State Maple Queen contest, which this year was judged by Ruthanne and Ronald Shaw of Ontario, Canada and Hank Peterson of Londonderry, New Hampshire. The runner-up Maple Queen is Emily Moller of Schoharie County. Our thanks to the three judges and also, Karen Keefer, who served as chairperson of the contest.

Once again, the Museum hosted an ice-cream social on July 4th, with entertainment by the Atkinson Family. We were proud to loan a very few artifacts to the Timbuctoo exhibit at the Adirondack Museum in Blue Mountain Lake. This exhibit celebrated the community of Timbuctoo, settled by African-American homesteaders in the 1840's. It seems that maple production was an important part of their livelihood.

By the time you read this, the Museum will have formally closed for the winter. But, we are happy to open for groups and individuals if arrangements are made in advance. The Museum will also be open to the public for a pancake breakfast in February. For further information, or to arrange a tour, do not hesitate to call 315-346-1107, or write to the Museum at PO Box 81, Croghan, NY 13327. A quote attributed to one Letty Pogrebin seems appropriate to the Museum:



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new friends to help us stay young.*



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# LIMITATIONS IN THE USE OF OZONE TO DISINFECT MAPLE SAP

By R.G. Labbe,\* M. Kinsley,  
and J. Wu

Food Microbiology Laboratory, Department of Food Science, University of  
Massachusetts, Amherst, Massachusetts 01003

## ABSTRACT

The sap of the maple sugar tree (*Acer saccharum*) contains 2 to 3% sucrose and is traditionally collected early in the year and concentrated by boiling to produce maple syrup. High levels of microorganisms in the sap occur during holding, leading to a darker syrup with lower economic value. We investigated the use of dissolved ozone as a method to reduce the microbial population in sap. After 40 min of ozone treatment, concentrations of up to 0.30 mg/liter were achieved but were ineffective in reducing the aerobic plate count. Three predominant colonies on nutrient agar were selected for isolation and identification from sap. These included one mucoid and one nonmucoid yeast, both identified as *Candida*, and *Pseudomonas fluorescens*. When suspended in buffer, each was readily inactivated by ozone. Addition of 3% sucrose to the buffer markedly reduced the effectiveness of ozone. With the use of an ozone generator with a larger ozone output, saturating ozone concentrations (1 mg/liter) were achieved within 5 min but were accompanied by only a 1-log reduction in aerobic plate count of maple sap. After 40 min of ozone treatment, a less than 3-log reduction occurred. The results indicate that, because of the presence of sucrose, ozone may be of limited use in reducing the microbial population in sap.

Maple sugar processing is an important seasonal activity in northern climates in North America. Its products, maple sugar and syrup, together with associated tourism activities, represent an important economic benefit to producers and the region. For example, for 1998 the production value of maple products alone was approximately US \$31 million and CAN \$126 million for the United States and Canada, respectively (2,3).

Maple products result from the boiling of sap from the sugar maple tree (*Acer saccharum*). Sucrose comprises 95% of the dry matter of sap, the balance consisting of amino acids, minerals, salts, and other compounds (11). Microbial growth during the collection and holding of sap can adversely affect the quality of the final product, especially with an increase in ambient temperature associated with the later part of the collection season. The quality of maple is based on its color and flavor, the lighter variety being of greater economic value. The enzymatic action of microorganisms on sap sucrose results in darker syrup and development of caramel flavor during the heat processing of sap (14), presumably due to, at least in part, nonenzymatic browning. Aseptic tapping of sugar maple trees results in higher-quality syrup (13) but is not a practical approach.

The documented effectiveness of aqueous ozone against various microorganisms (15) suggested its potential usefulness as a method of reducing microbial loads during the holding of sap. Ozone has been used for decades as a sanitizing agent of drinking water. Its recent affirmation in the United States as a generally recognized

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rlabbe@foodsci.umass.edu.



safe substance will likely trigger interest in its application to food processing (8). Indeed, its effectiveness in inactivating foodborne pathogenic bacteria has been demonstrated (4, 15). A recent review by Kim et al. (10) identified applications of ozone in the processing of various commodities. Herein, we report the usefulness of ozone as a method of reducing the microbial levels in maple sap.

## MATERIALS AND METHODS

**Mircoorganisms.** Microbial isolates used in this study were obtained from fresh maple sap. One-tenth milliliter was spread plated onto nutrient agar. Three predominant colonies were selected for isolation and identification. Two were yeasts and the third was a gram-negative, motile rod, which was identified by a commercial consulting laboratory as *Pseudomonas fluorescens* using fatty acid profiling techniques. The yeasts, one mucoid and the other nonmucoid, were each identified as *Candida* spp. by similar techniques by the same laboratory. Identification at the species level was unsuccessful by fatty acid profiling and biochemical and morphological characterization. Each isolate was maintained by periodic transfer to nutrient agar slants, incubated at 20 (yeasts) or 32<sup>o</sup> (*P. fluorescens*) for 2 days, and held at 4<sup>o</sup>C.

**Electron microscopy.** Isolates were streaked onto nitrocellulose filters placed on top of Sabouraud dextrose agar (yeasts) or nutrient agar (bacterium). After growth at 20<sup>o</sup>C, the filters were examined using a JSM-5400 scanning electron microscope as previously described (7).

**Ozone treatment.** Initial experiments involved the use of thawed maple sap

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obtained from a local producer of maple products. Experiments were designed to mimic procedures that might be used on a larger scale in field operations. To this end, a stream of ozone was introduced at time zero to samples containing microorganisms (sap or isolated cultures suspended in buffer) rather than the addition of microorganisms to reservoirs containing established ozone concentrations.

Eight hundred milliliters of sap was placed in a 1-liter glass jar and ozone introduced into the bottom of the jar via Tygon tubing fitted to the outlet of an ozone generator. A diffuser stone was attached to the tubing outlet, and the contents of the jar were stirred. Ozone was generated using a Clearwater Tech (San Luis Obispo, Calif.) model UV-275 or UV-2800 with air as the feed gas. Each had a rated output of 0.1 and 1.0 g of ozone per h, respectively. Ozonation was conducted in an exhaust hood.

Each microbial isolate was also exposed to ozone. For this purpose, 500-ml cultures of yeasts and *P. fluorescens* were grown in yeast and mold broth (Difco Laboratories, Detroit, Mich.) or tryptic soy broth (Difco) at 20 or 32°C, respectively, with shaking. Cells (10 ml) were collected at late log phase using a previously determined standard curve (600 nm). Cells were washed twice with 1 mM phosphate buffer, pH 6.0, and resuspended in 10 ml of the same buffer. Eight milliliters were added to 792 ml of the same buffer, yielding initial levels of between 10<sup>5</sup> and 10<sup>6</sup> of viable cells per ml. Following exposure to ozone for various times, decimal dilutions were made in 1.5% peptone and surface plated on Sabouraud dextrose agar (yeasts) or nutrient agar (*P. fluorescens*) and incubated at 20°C for 3 days (yeasts) or 32°C for 2 days (*P. fluorescens*). No increase in survivors was obtained if plates were held for 5 days instead of 3. In certain experiments, 3% sucrose (ACS grade, Sigma Chemical Co., St. Louis, Mo.) was

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added to the buffer into which ozone was generated. All experiments were done in duplicate.

**Measurement of ozone.** The amount of ozone generated was measured by the iodometric method (1).

## RESULTS

Use of the smaller of two ozonators failed to result in any reduction in the aerobic plate count (APC) of maple sap after 40 min, despite oxidizing activity of approximately 0.30 mg/liter (Fig. 1).

We then wished to determine if the microbial population was inherently resistant to ozone treatment. Three predominant microorganisms from sap, two yeasts and one bacterium, were isolated as described in the "Materials and Methods" section. The two yeasts, one mucoid and one nonmucoid, were identified as *Candida* and the bacterium as *P. fluorescens*. Each yeast produced pseudomycelia (Fig. 2A) with characteristic budding (Fig. 2B). Sheneman and Costilow (17) had identified *Candida* and *Pseudomonas* as among the predominant genera isolated from maple tree tap holes.

When yeasts were suspended in 1 mM phosphate buffer, pH 6.0, ozone was readily effective in reducing the viability of the two yeast isolates. A 2.5- to 3-log inactivation of the mucoid yeast was observed within 15 min at an ozone concentration of approximately 0.2 mg/liter (Fig. 3). In the case of the nonmucoid yeast, more than a 4-log reduction occurred within 5 min at an ozone concentration of less than 0.1 mg/liter (Fig. 4). Addition of 3% sucrose to the buffer dra-

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matically reduced ozone effectiveness in each case (Figs. 3 and 4). This is the approximate concentration of sucrose found in maple sap. A similar quenching of ozone effectiveness by sucrose was also observed in the case of *P. fluorescens* (non shown). In that case, a 6-min exposure to ozone was required to obtain a 3-log reduction in viable count, whereas 20 min was required in the presence of sucrose. Interestingly, high oxidizing activity was measured in the presence of sucrose (Figs. 3 and 4). The action of ozone on sucrose apparently created unknown reactive species. An ozone generator with a larger output was used in an attempt to reduce microbial counts in sap (Fig. 5). This unit had a rated output 10-fold greater than the smaller unit, although the dissolved ozone concentration differed by only threefold. With this unit, saturating levels of ozone concentration were reached within 5 min. Nevertheless, after 20 min only a 1-log reduction in the microbial population was achieved; even after 40 min, a less than 3-log reduction in APC was obtained.

## DISCUSSION

The well-known effectiveness of ozone in inactivating microbial cells suggested its use in the processing of maple sap in which high levels of microorganisms can occur during holding at ambient outdoor temperatures. It was, surprisingly,

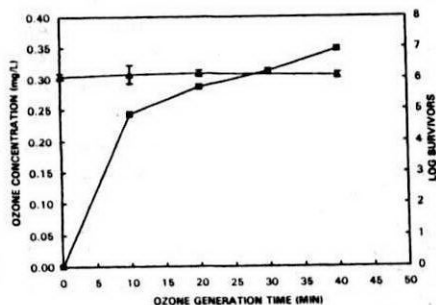


FIGURE 1. Effect of ozone on APC of maple sap. Triangles, log survivors; squares, ozone concentration.

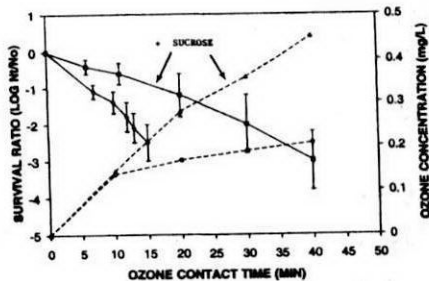


FIGURE 3. Inactivation by ozone of a mucoid yeast isolated from maple sap in the presence or absence of 3% sucrose. Yeasts were suspended in 1 mM phosphate buffer, pH 6.0. Solid lines, yeast survivors; dotted line, ozone concentration.

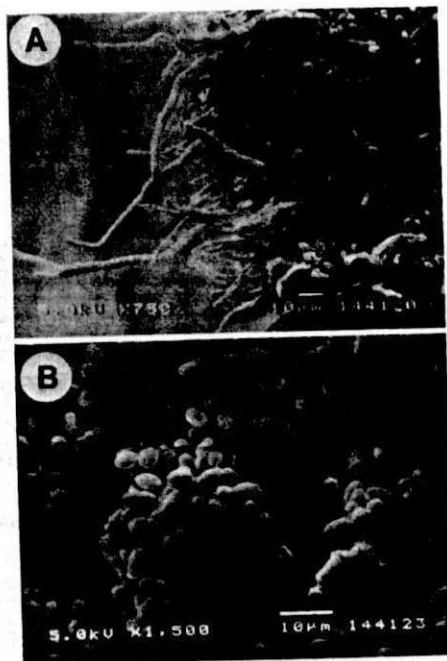


FIGURE 2. Scanning electron micrograph of yeasts isolated from maple sap showing pseudomycelia (A) and budding (B).

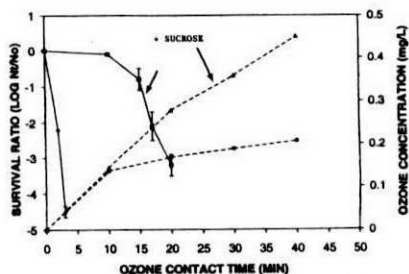


FIGURE 4. Inactivation by ozone of a non-mucoid yeast isolated from maple sap by ozone in the presence or absence of 3% sucrose. Yeasts were suspended in 1 mM phosphate buffer, pH 6.0. Solid line, yeast survivors; dotted line, ozone concentration.

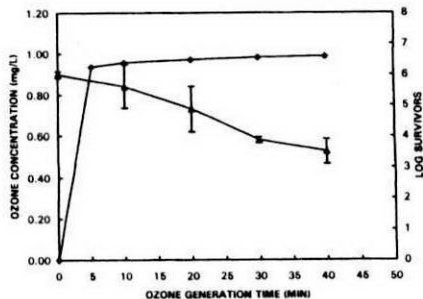


FIGURE 5. Reduction in APC of maple sap by saturating concentrations of ozone. Triangles, log survivors; diamonds, ozone concentrations.

only moderately effective, with less than a 3-log reduction in APC after 40 min even under saturating concentration of ozone, approximately 1 mg/liter.

By contrast, individual yeasts and one bacterium isolated from sap were readily inactivated by ozone when suspended in buffer at ozone concentrations of less than 0.15 mg/liter. Inactivation by ozone was markedly affected by the presence of 3% sucrose. We conclude that sucrose quenched the lethal activity of ozone. It has been previously shown that organic matter can affect the antimicrobial activity of ozone (5, 15, 16). This appears to be dependent on the type of organic material and microbial species. For example, Restaino et al. (15) reported that the death rates of *Escherichia coli* and *Salmonella Typhimurium* were significantly reduced by bovine serum albumin but not by soluble starch.

The antimicrobial activity of ozone has long been known. Less clear is its mode of action. Suggestions for primary targets include unsaturated lipids in the cell surface, enzyme sulfhydryl groups, nucleic acids, and others. Proposed mechanisms for inactivation have been recently summarized (10). The reactivity of ozone is believed to be due to the oxidizing power of free radicals formed in a chain reaction during its decomposition. Indeed, ozone molecules themselves may be relatively nontoxic to microorganisms (6). Organic matter may inhibit this chain reaction (9), although, to our knowledge, the specific interaction of sucrose and ozone has not been investigated. Sucrose may not be the only organic material present and affecting ozone activity. Exopolysaccharides may also be present in sap. Indeed, low-grade sap can contain substantial amounts of such polysaccharides and results in ropy or stringy maple syrup (12). In fact, one of the yeasts isolated in the present work produced mucoid colonies.

To demonstrate any reduction in APC using sap, it was necessary to use an ozone generator with an output greater than the unit that was effective in inactivating yeasts and bacteria suspended in buffer. Associated equipment costs and electrical consumption were each approximately three-fold greater for a volume of 800 ml of sap. This leads to another issue, that of capital costs and operating expenses. The ozone generation systems used in this work are based on exposure of air to UV light. For volumes of maple sap greater than those used herein, alternative methods for ozone generation, such as the corona discharge method, would be required to achieve significant microbial inactivation. Given the results

reported herein, such proposed procedures must be demonstrated by pilot studies using sap collected at various stages of the collection period. Finally, empirical and experimental evidence has long shown that cold storage of sap before quick processing yields lighter-grade syrup. Although aseptic tapping is not practical, disinfection of drill bits, spouts, and collection equipment is a reasonable protocol (13).

### ACKNOWLEDGMENTS

This work was supported in part by a University of Massachusetts Public Service Endowment Grant and by a grant from the North American Maple Syrup Council. We are grateful to South Face Farms, Ashfield, Massachusetts for providing maple sap.

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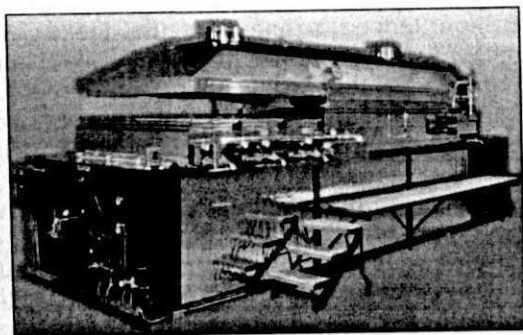
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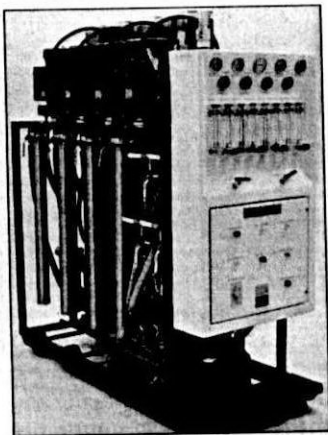
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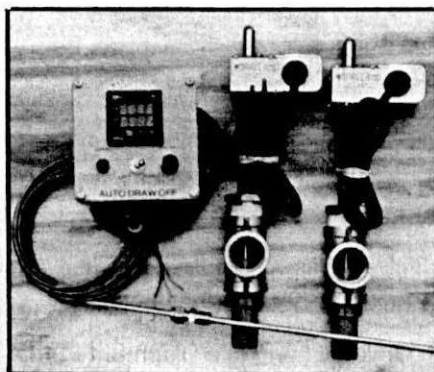
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## 2002 NEW YORK MAPLE TOUR ANNOUNCED

The New York State Maple tour committee is hard at work planning a great 2002 Maple Tour. The 2002 tour is hosted by The Delaware County Maple Producers Association and The Catskills Maple Producers Association of New York. The tour will be centered in Delhi, NY located in the North Western Catskill Mountains. Tour dates are July 18, 19 and 20th, 2002.



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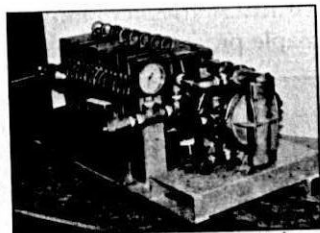
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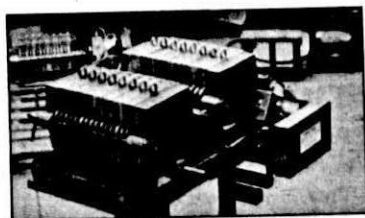
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# NEW YORK MAPLE TOUR July 19-21, 2000

*By Marion Wells*

The 2001 New York Maple Tour was hosted in Western NY by the producers in Allegany and Cattaraugus Counties. The tour was headquartered at Randy Spragues magnificent new pancake house and restaurant in Portville, NY.

The tour began on Thursday evening with registration and a social hour that included demonstrations of making granulated sugar, maple cotton candy and molded maple sugar. Producers had a chance to visit with numerous vendors to learn what was new in maple equipment and supplies.

Friday was tour day with many interesting stops. A stop at Dave Slocum's woods showed a tubing layout with discussion by forester Dave Waldron. Next at Moore's pancake house many innovative marketing ideas were shown, along with many production ideas. A stop at Boberg's sugar house introduced us to a great fuel supply - their own gas well! They also have a great team of Belgians that are used to haul the sap wagon. Doug Myers sugar house handles a 1000 tap operation all on tubing, and using a 3' x 10' evaporator. Wrights Farm has a new sugar house with some very impressive equipment. Most of their taps are on vacuum. They use a 6' x 16' evaporator and a steamaway on a forced air wood fired arch.

Saturday's tour began at Randy Spragues maple plantation where a

new bush of sweet trees is fighting to stay ahead of a large deer population. Randy uses plastic tubes to protect the saplings from the deer rubbing and grazing. Randy also showed us the use of a remote sap releaser emptying sap into a tank while the vacuum was supplied from the sugar house hundreds of feet away. Spragues new facility not only houses a full time restaurant, but a maple equipment sales section, and a sap to syrup processing section that is available for visitors to see. The restaurant seats 250 or more guests and contains some interesting wildlife. The 'four bears' were dining at one table while over on the wall a large woodpecker was heard and seen tapping away. Across the room a large wooden bucket was home to a raccoon who slowly rises up to look around, then slowly sinks out of view. Your children or grandchildren will love this place!

Also on Saturday's tour was the sugar house at the Allegany County Fair. Old and new equipment exhibits were shown. The fair was in progress and State Maple Queen Ruth Dowe was there to greet visitors. Our last stop was at Carrier & Sons. Joe Carrier has memories of his father and grandfather boiling sap into syrup. Now Joe's sons are carrying on a family tradition. Carriers pipe sap from long distances across a valley to the sugar house from one direction, and an equally long distance from another direction.

This years tour was excellent. Many people travelled long distances to get there and were not disappointed. This was certainly the best of the 2001 maple tours!

## COMING EVENTS

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### NAMSC AND IMSI ANNUAL MEETING

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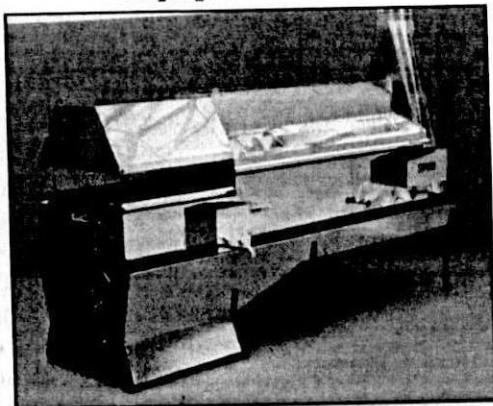
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# IN MEMORIUM

## PUNTAM ROBBINS

Putnam W. Robbins, 98, of Spread Eagle, Wisconsin, died May 28, 2001 at his home in Spread Eagle. He was born in Iron Mountain, Michigan, June 29, 1902 and graduated from Michigan State University with a degree in forestry.

Mr. Robbins studied at the school of forestry at Oregon State University. He had started maple syrup research projects at Dunbar Forest and continued with projects at the "Sugar Bush" on the campus of MSU.

He developed a steam evaporator for converting sap to syrup and proved that tapping all quadrants of a maple tree was profitable.

Mr. Robbins helped give birth to the North American Maple Syrup Council and served as its secretary/treasurer for three years. In 1984, he was inducted into the North American Maple Syrup Hall of Fame in Croghan, N.Y.

He authored many research articles covering subjects as diverse as Michigan farm lots to maple syrup production. He had been a member of the Society of American Foresters since 1929 and was Michigan registered forester number 13.

## TURE L. JOHNSON

Burton Township — Ture Johnson, who became one of only three state farm foresters when he came to Ohio in 1945, died June 5, 2001 in Briar Hill Nursing Home in Middlefield. He was 87.

He was born in Gwinn, Michigan and graduated from the Michigan State University School of Forestry in 1937.

As a state forester for nearly 40 years, Ture helped farmers maintain healthy trees and improve woodlands. He also advised communities on cutting trees.

His family said he used much of his spare time planting more than a million trees of various species in Northeastern Ohio over 35 years. He helped establish Tree City USA designations for many cities in Northeast Ohio, including Cleveland Heights and Shaker Heights.

He retired in the early 1980s, but continued consulting

Ture was a founding member of the Berkshire Athletic Booster Club where he was instrumental in establishing a lighted football stadium. He also briefly coached the Burton High School basketball team and was a volunteer with the Burton Fire Department.

He was a member of the Burton Chamber of Commerce for 50 years, and served on the Geauga Maple Festival Board for more than 40 years.

He helped organize the Ohio Christmas Tree Growers Association, Inc. and the National Maple Syrup Council in 1960. He won several awards for conservation and tree growing.

Ture was inducted into the National Maple Syrup Hall of Fame in Croghan, N.Y. in 1980.



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